Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/491
SPAIN
February 1964
Original: SPANISH

Confidential until official release during Conference

Abstract

PRODUCTION OF STABLE ISOTOPES IN SPAIN

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The paper describes work carried out under the stable-isotope-production programme on the separation of stable isotopes by ion-exchange chromatography and thermal diffusion. With the former technique, a study was made of the separation of N^{14}, N^{15}, B^{10} and B^{11}. This work included laboratory-scale experiments carried out with a view to determining the separation factor by means of the breaking-point technique.

For nitrogen, use was made of ammonium hydroxide, chloride and acetate; only the first of these proved suitable for obtaining a good separation. Experimental conditions, e.g. flux velocity and concentration, were varied so as to ascertain their influence on the separation factor. Use was made of the strongly acidic cationic resin Dowex 50W (100-200 mesh). In the favourable case of ammonium hydroxide the values for the separation factor varied between 1.028 and 1.022, depending upon experimental conditions.

In the case of boron, the strongly basic resins Dowex 1 and Dowex 2 (100-200 mesh and 200-400 mesh) were used to study boric acid and sodium borate compounds and complexes of boric acid with mannite and glycerine. The highest separation factor was obtained with boric acid (1.035-1.027, depending upon concentration); reasonable values were also found with mannite (1.024) and glycerine (1.027) complexes. With sodium borate, the separation factor diverges only slightly from unity.

In the case of both nitrogen and boron, these experiments confirm the need for employing complexes of these substances that are slightly ionized in solution in order to obtain separation factors appreciably different from unity.

Laboratory experiments were carried out to study the separation of nitrogen and boron isotopes by means of displacement development chromatography. In the case of nitrogen, a band of ammonium hydroxide was fixed on a cationic resin in hydrogen form and was displaced by sodium hydroxide. For boron, a boric-acid band was fixed on an anionic resin in OH form and displacement carried out by means of acetic acid.

A pilot plant for the separation of stable isotopes by means of ion-exchange chromatography has been built; this installation is automatically controlled and is designed for continuous operation.

In the course of the thermal diffusion investigations, a study was made of the separation of the various isotopes of the noble gases, oxygen, nitrogen and carbon-13. The object of this work was to: (a) correlate theoretical and experimental data in different types of column; (b) determine the thermal diffusion co-efficients of isotopic mixtures in cylindrical columns and study the distribution of multi-component mixtures with a view to discovering gases capable of acting as "filters".

A 90° sector mass spectrometer has been built for measuring isotope abundance ratios between 1 and 400 amu.